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(54) **Drive device for operating a vehicle door**

(57) The invention relates to a drive device (3) for operating the vehicle door (2), in particular the tailgate, of a motor vehicle (1), which contains an actuator (4) connected to the vehicle door (2) and to the body (7) of the motor vehicle (1), the actuator (4) comprising a tubular housing (8) in which at least two drive components (10; 12; 12'; 13; 13'; 14) are arranged consecutively axially, characterized in that at least two consecutive drive components (10; 12; 12'; 13; 13'; 14) comprise between them at least one damping device (18; 18'; 20; 20') for the insulation of structure-borne noise.

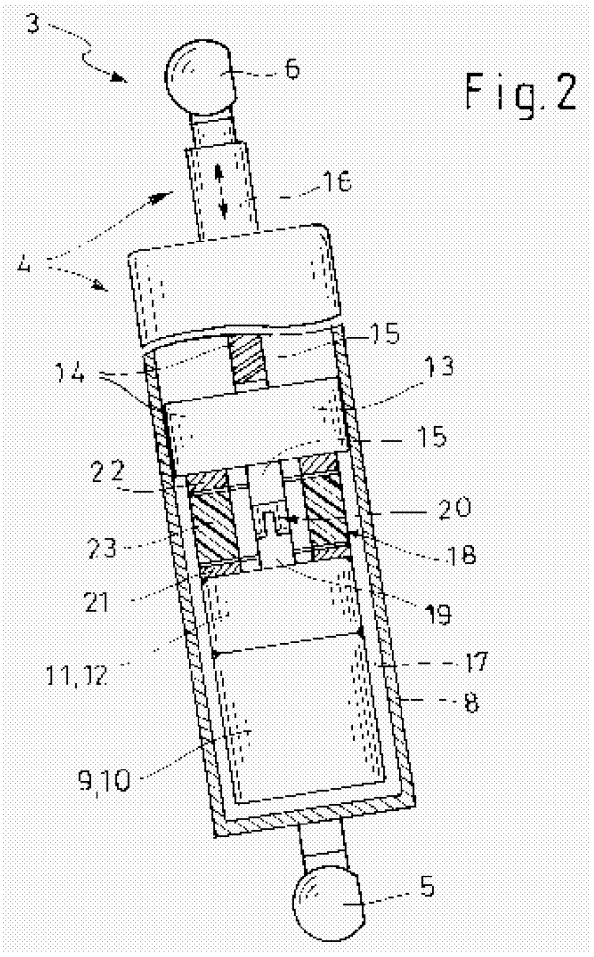

Fig. 2

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Description

[0001] The invention relates to a drive device for operating the vehicle door, in particular the tailgate, of a motor vehicle, which contains an actuator, and preferably two connecting devices provided for connecting the actuator on the one hand to the vehicle door and on the other hand to the body of the motor vehicle, the actuator comprising a tubular housing in which at least two drive components, such as an electric motor provided with a housing part, shafts of the electric motor which are required for the transmission of rotational movement, an intermediate gear provided with a housing part and a spindle drive having a spindle bearing which is adjacent to the intermediate gear and is fastened to the tubular housing, are arranged consecutively axially.

[0002] A known drive device of this type serves in particular for opening and closing the tailgate of a motor vehicle and has the external form of a gas-strut or gas-filled spring, with the spindle drive which is arranged in the tubular housing being operatively connected to an active element, which can be moved telescopically out of the housing, in order to operate the vehicle door.

[0003] A disadvantage of this known drive device is that the vibrations produced by the electric motor and/or the intermediate gear (structure-borne noise vibrations) are transmitted via the tubular housing of the actuator and the active element directly to the vehicle body or to the tailgate. When such a drive device is fixed on the body of the vehicle or of the tailgate, the acoustically perceptible level which is already present due to other components of the vehicle rises further.

[0004] One object of the present invention concerns a drive device for operating a vehicle door, in which a transmission of the vibrations produced in particular by the electric motor and/or the intermediate gear of the actuator to the body of the vehicle is avoided in a simple manner or is substantially reduced.

[0005] This object is achieved according to the invention by the features of Claim 1. Further particularly advantageous refinements of the invention are disclosed by the dependant claims.

[0006] The invention is essentially based on the concept that at least two consecutive drive components comprise between them at least one damping device for the insulation of structure-borne noise.

[0007] Advantageously, a further damping device is arranged between the housing parts of the drive components and the tubular housing in such a manner that there is no direct contact, conducting structure-borne noise, between these housing parts and the tubular housing of the actuator.

[0008] Advantageously, at least one damping device for the insulation of structure-borne noise is arranged between the housing part of the electric motor and the housing part of the intermediate gear and/or between the housing part of the intermediate gear and the spindle bearing, and/or at least one second damping device for the insulation of structure-borne noise is provided between the shafts of the electric motor, which are required for the transmission of rotational movement, and the intermediate gear and/or the output shaft of the intermediate gear and the spindle of the spindle drive or an adapter part connected at the spindle bearing.

[0009] In a first embodiment of the invention, the first damping device is composed of two plate-like retaining elements which are generally composed of metal and between which an elastic element is arranged. In this case, the elastic element of the first damping device can be connected nonreleasably to the plate-like retaining elements, for example by means of vulcanization, adhesion or adhesive bonding.

[0010] Furthermore it has proven advantageous if the first retaining element is connected to the housing part of the electric motor or to the housing part of the gear by means of a screw connection and has threaded bores into which screws are screwed and then connect the second retaining element and the elastic element to the first retaining element.

[0011] In a further advantageous embodiment of the invention, the first damping device comprises the mutually facing housing parts of the electric motor and the intermediate gear or of the intermediate gear and the spindle bearing, which housing parts are designed in the form of gear wheels, with the one subassembly (for example the spindle bearing) having an first toothing and the respectively other subassembly (for example the intermediate gear) having an complementary toothing, so that the teeth of the adjacent subassemblies intermesh without coming into contact, and with the respective intermediate spaces between the teeth of the adjacent subassemblies being connected to one another by an elastic element.

[0012] The teeth and the elastic element can be designed in such a manner that the teeth come to bear against the adjacent teeth only if a certain torsional load is exceeded, in order to avoid overloading of the elastomer during the correct use of the drive device.

[0013] The second damping device may be, for example, a torsionally elastic shaft coupling embodied as a toothed ring. However, the second damping device may also comprise a damping bushing with an internal and external bushing and an elastic element situated in between, the external bushing being formed by the shaft of one of the two adjacent subassemblies.

[0014] Rubber or a flexible plastic, in particular a thermoplastic elastomer (also referred to below as TPE elastomer) can be used as the elastic element.

[0015] Finally, it may also be provided that, in addition to the insulation of the structure-borne noise between the individual subassemblies of the actuator, the entire actuator is also mounted elastically between the connecting devices and therefore additional absorbing of the structure-borne noise takes place.

[0016] Further details and advantages of the invention emerge from the following exemplary embodiments ex-

plained with reference to figures, in which:

Fig. 1 shows a schematic perspective view of the rear region of a motor vehicle with the tailgate opened and a drive device according to the invention arranged at the side;

Fig. 2 shows an enlarged illustration of the drive device according to the invention, which is only illustrated schematically in Fig. 1;

Fig. 3 shows an exploded illustration of the first damping device, illustrated in Fig. 2, with the adjacent subassemblies of the actuator;

Fig. 4 shows a detail, reproduced as a longitudinal section, of a second exemplary embodiment of a drive device according to the invention, and

Fig. 5 shows a cross section of the actuator illustrated in Fig. 4, along the section line referred to there by V-V.

[0017] In Fig. 1, 1 refers to a motor vehicle which has a tailgate 2 which can be pivoted by a drive device 3 according to the invention from a closed position into the opened position illustrated in Fig. 1 and, if appropriate, into the closed position again.

[0018] The drive device 3 comprises an actuator 4 and two connecting devices (ball sockets of corresponding angle joints) 5, 6 via which the actuator 4 is connected on the one hand to the body 7 of the motor vehicle 1 and on the other hand to the tailgate 2. The tailgate 2 may also be pivoted by two drive devices.

[0019] The actuator 4 comprises a tubular housing 8 (Fig. 2) in which a plurality of drive components are arranged consecutively axially. More precisely, the actuator 4 comprises consecutively on one axis an electric motor 10 provided with a housing part 9, an intermediate gear 12 provided with a housing part 11 and a spindle bearing 13 of a spindle drive 14, which spindle bearing is fastened to the tubular housing 8. The spindle 15 of the spindle drive 14 interacts with an axially guided spindle nut (not illustrated) which, for its part, axially displaces an active element 16 of the actuator 4, which active element acts on the tailgate 2 and can be pushed out of the housing 8 and retracted into it telescopically.

[0020] According to the invention, provision is firstly made for damping device formed by an annular air gap 17 to remain between on the one hand the housing part 9 of the electric motor 10 and the housing part 11 of the intermediate gear 12 and on the other hand of the tubular housing 8 of the actuator 4, so that the structure-borne noise produced by the electric motor 10 or the gear 12 is not transmitted directly to the tubular housing 8.

[0021] Instead of the annular air gap, the damping device could be provided by a foam or/by an elastomer. Such a damping material can also be used advantageously to centre the electric motor 10 and the intermediate gear 12 in the tubular housing 8.

[0022] Secondly, a damping device 18 is provided between the housing part 11 of the intermediate gear 12 and the spindle bearing 13, and a second damping device 20 is provided between the output shaft 19 of the intermediate gear 12 and the spindle 15 of the spindle drive 14.

[0023] The first damping device 18 comprises two plate-like retaining elements 21, 22 of metal between which an elastic element 23 of rubber or a suitable TPE elastomer is situated. As can be gathered from Fig. 3, the retaining elements 21, 22 and the elastic element 23 are connected to one another. In this case, the first retaining element 21 is connected to the housing part 11 of the intermediate gear 12 by means of a set of four screws 24. The screws 24 are mounted in corresponding depressions of the elastic element 23.

[0024] The spindle bearing 13 is connected to the first damping device 18 by a second set of four long screws 25, these long screws 25 being screwed into threaded bores 26 of the second retaining element 22.

[0025] The first damping device 18 can be a premanufactured element composed of two plate-like retaining elements and the elastic element is connected nonreleasably to the plate-like retaining elements, for example by means of vulcanization, adhesion or adhesive bonding. However, a screw connection between the plate-like retaining elements and the elastic element can also be realized to build the first damping device 18.

[0026] Of course, a damping device 18 which is already premanufactured can also be connected directly to the housing of the intermediate gear 12 by means of screws, thus resulting in a unit which comprises electric motor 10, intermediate gear 12 and damping device 18 and is then screwed, for example from the inside of the housing of the spindle bearing 13 to the latter (i.e. with the spindle removed).

[0027] The second damping device 20 comprises a torsionally elastic shaft coupling embodied as a toothed ring, with rubber or a TPE elastomer having preferably been used as the material for the shaft coupling.

[0028] Figs 4 and 5 show a further exemplary embodiment of the invention. Also in this exemplary embodiment, the first and second damping devices 18', 20' are arranged between an intermediate gear (here a planetary gear) 12' and the spindle bearing 13' of a spindle drive.

[0029] In this exemplary embodiment, the mutually facing housing parts 11', 27 of the intermediate gear 12' and of the spindle bearing 13' are designed in the form of gear wheels, the spindle bearing 13' having an internal toothing and the intermediate gear 12' having an external toothing. The teeth 28, 29 of the adjacent subassemblies intermesh without coming into contact (Fig. 5). The intermediate space remaining between the teeth 28, 29 is filled by an elastic element 30, for example of rubber or a TPE elastomer.

[0030] In the case of the exemplary embodiment illus-

trated in Figs 4 and 5, the spindle bearing 13' is lengthened axially in the direction of the intermediate gear 12' by means of an adapter part 27 with an internal toothing. The adapter part 27 is fixed here to the spindle bearing 13' with the aid of screws 31 extending in the radial direction. So that the adapter part 27 does not transmit the full torsional load of, for example, 10 Nm to the screws 31, a toothing between spindle bearing 13' and adapter part 27 ensures a transmission of force in the tangential direction. Only small loads become effective radially.

[0031] Of course, the adapter part and the adjoining region of the spindle bearing may also be formed as a single part. Provision may also be made to replace the screws by clips.

[0032] In this exemplary embodiment, a damping bushing with an internal and external bushing 32, 33 made in each case of metal and between which an elastic element 34 is arranged serves as the second damping device 20'. The external bushing 33 can be formed here, as illustrated in Figs 4 and 5, by the output shaft 19 of the intermediate gear 12'.

Claims

1. Drive device for operating the vehicle door (2), in particular the tailgate, of a motor vehicle (1), which contains an actuator (4) connected to the vehicle door (2) and to the body (7) of the motor vehicle (1), the actuator (4) comprising a tubular housing (8) in which at least two drive components (10; 12; 12'; 13; 13'; 14) are arranged consecutively axially, **characterized in that** at least two consecutive drive components (10; 12; 12'; 13; 13'; 14) comprise between them at least one damping device (18; 18'; 20; 20') for the insulation of structure-borne noise.

2. Drive device according to Claim 1, **characterized in that** a further damping device (17) is arranged between the drive components (10; 12; 12') provided with a housing part (9; 11; 11') and the tubular housing (8) in a manner insulating structure-borne noise.

3. Drive device according to Claim 2, **characterized in that** the further damping device (17) is formed by an air gap or by a foam.

4. Drive device according to one of Claim 1 to 3, **characterized in that** at least one damping device (18; 18') is provided between the housing part (9) of the electric motor (10) and the housing part (11; 11') of the intermediate gear (12; 12').

5. Drive device according to one of Claim 1 to 4, **characterized in that** at least one damping device (18; 18'; 20; 20') is provided between the housing part (11; 11') of the intermediate gear (12; 12') and the spindle bearing (13; 13'; 27).

6. Drive device according to one of Claim 4 or 5, **characterized in that** the damping device (18') comprises the mutually facing housing parts (27, 11') of the two drive components (10; 12'; 13'), these housing parts (27, 11') being designed in the form of gear wheels in such a manner that the one subassembly (13, 27') has an first toothing and the respectively adjacent subassembly (12') has an complementary toothing, so that the teeth (28, 29) of the two subassemblies (12', 13') intermesh without coming into contact, and **in that** the respective intermediate spaces between the teeth (28, 29) of adjacent subassemblies (12', 13') are connected to one another by an elastic element (30).

7. Drive device according to one of Claim 1 to 6, **characterized in that** at least one damping device (20; 20') is provided between the shafts of the electric motor (10), which are required for the transmission of rotational movement, and the intermediate gear (12; 12').

8. Drive device according to one of Claim 1 to 7, **characterized in that** at least one damping device (20; 20') is provided between the output shaft (19) of the intermediate gear (12; 12') and the spindle (15) of the spindle drive (14).

9. Drive device according to one of Claims 7 or 8, **characterized in that** the damping device (20) comprises a torsionally elastic shaft coupling embodied as a toothed ring.

10. Drive device according to one of Claims 7 or 8, **characterized in that** the damping device (20') comprises a damping bushing with an internal bushing (32) and an external bushing (33) and an elastic element (34) situated in between, the external bushing (33) being formed by the shaft of one of the two adjacent subassemblies (12').

11. Drive device according to anyone of previous Claims, **characterized in that** the damping device (18) comprises two plate-like retaining elements (21, 22) between which an elastic element (23) is arranged.

12. Drive device according to Claim 11, **characterized in that** the retaining elements (21, 22) are composed of metal.

13. Drive device according to one of Claim 11 or 12, **characterized in that** the elastic element (23; 30; 34) is composed of rubber or a flexible plastic.

14. Drive device according to one of Claim 10 to 13, **characterized in that** the elastic element (23) of the damping device (18) is connected nonreleasably to

the plate-like retaining elements (21, 22).

15. Drive device according to one of Claim 10 to 14, **characterized in that** the first retaining element (21) is connected to the housing part (9) of the electric motor (10) or to the housing part (11) of the intermediate gear (12) by means of a first screw connection and the second retaining element (22) is connected to the spindle bearing (13) by means of a second screw connection (25).

16. Drive device according to one of previous claims, **characterized in that** the entire actuator (4) is mounted elastically between two connecting devices (5, 6).

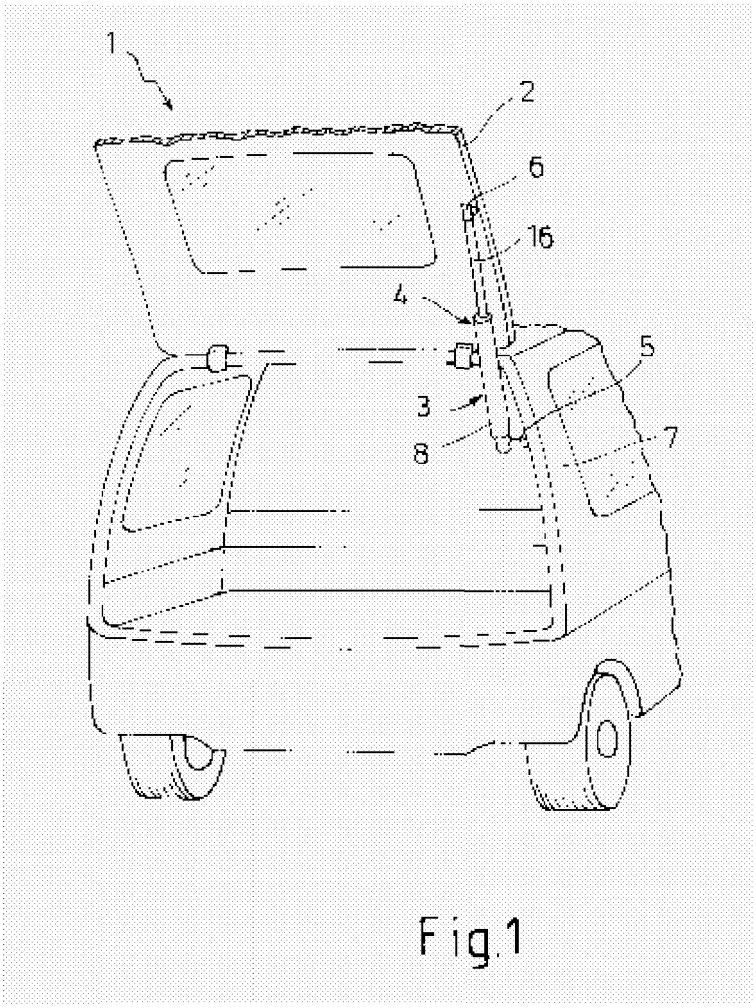

Fig.1

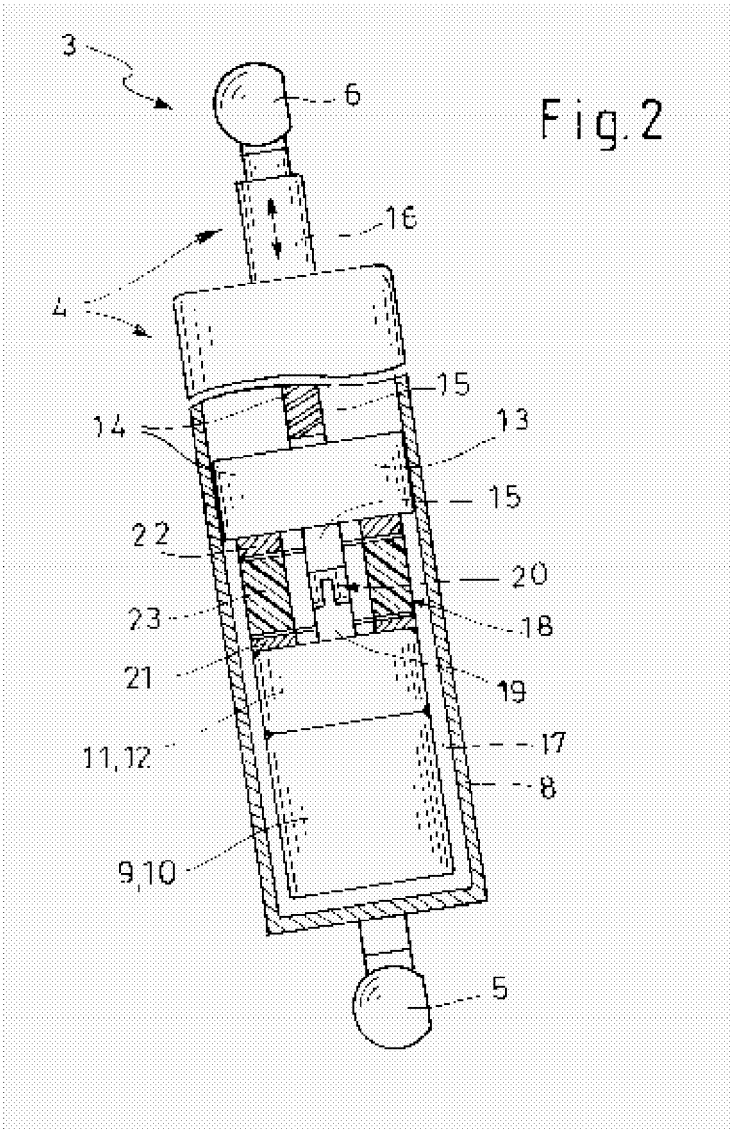

Fig. 2

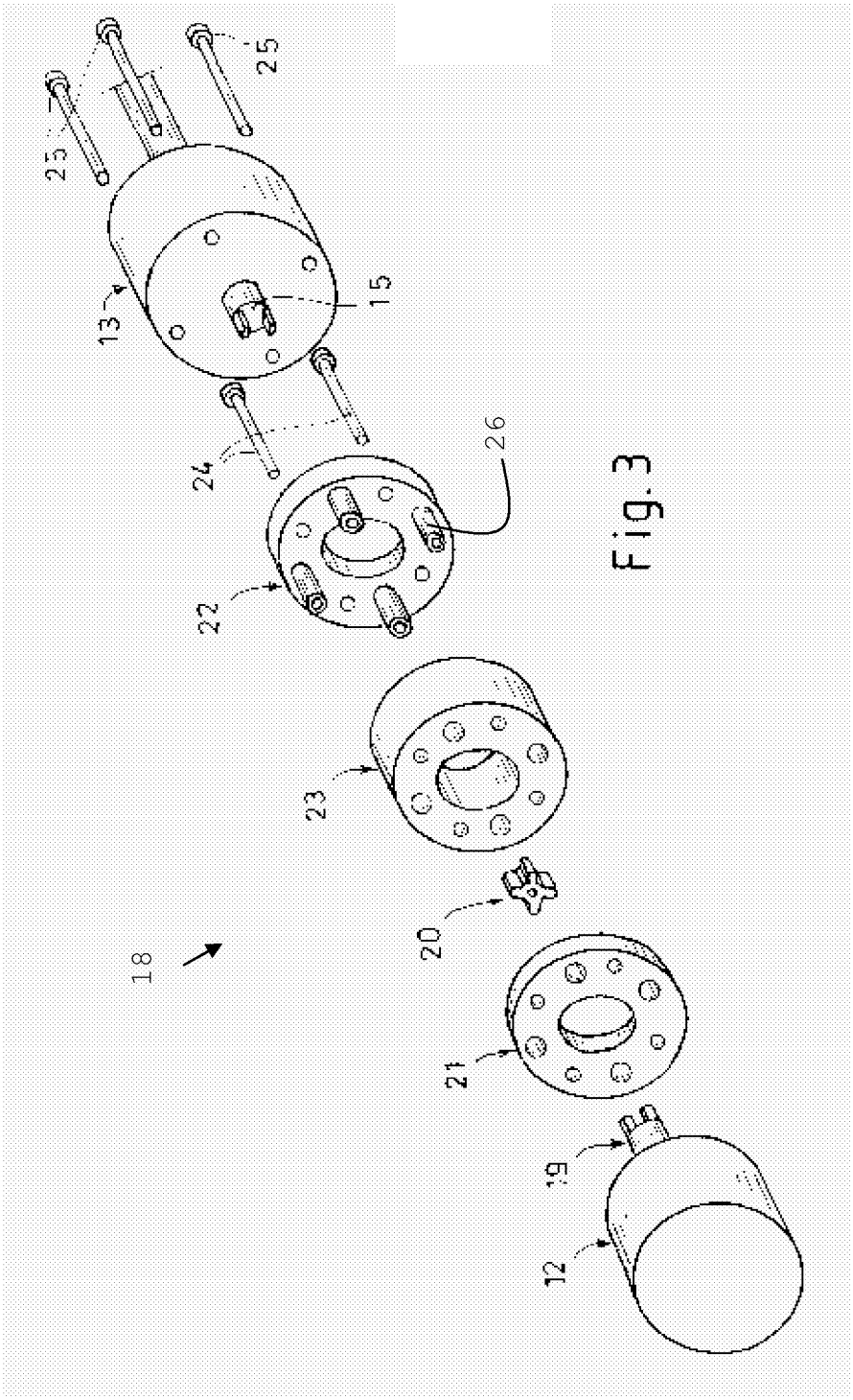

Fig.3

Fig.4

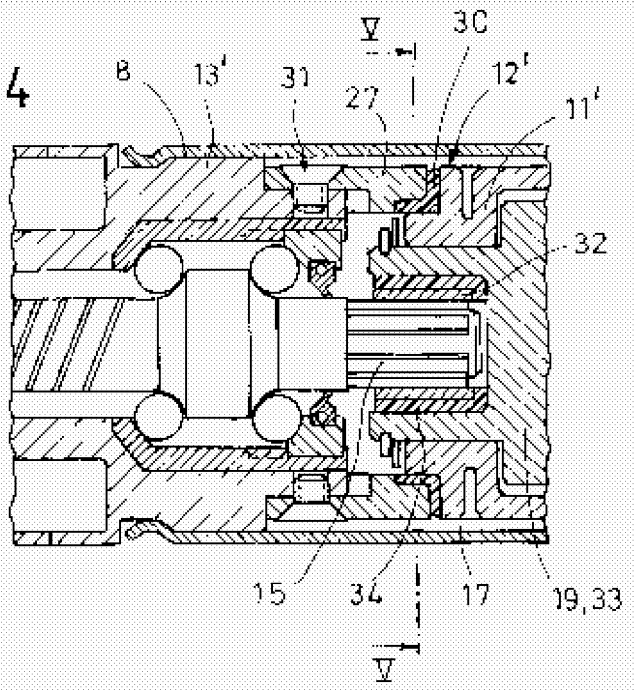
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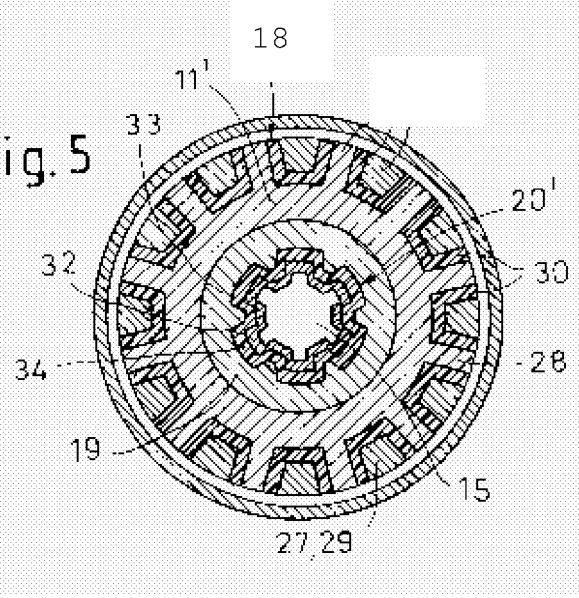
Fig.5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EUROPEAN SEARCH REPORT

Application Number
EP 07 10 7270

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	DE 195 19 948 A1 (BEIKIRCH INDUSTRIEELEKTRONIK G [DE]) 12 December 1996 (1996-12-12)	1	INV. E05F15/12
Y	* column 1, line 54 - column 2, line 21; claim 1; figure 1 *	2,3,7	
A		4-16	

Y	US 2006/082188 A1 (MITCHELL STEPHEN A G [CA]) 20 April 2006 (2006-04-20)	2,3	
A	* paragraph [0013] - paragraph [0015]; claim 1; figures 1,2 *	4-16	

Y	US 6 195 940 B1 (MOY CURTIS T [US]) 6 March 2001 (2001-03-06)	2,3	
A	* column 3, lines 28-35; figure 5 *	4-16	

Y	DE 10 2005 047309 A1 (KIRCHHOFF GMBH & CO KG [DE]) 5 April 2007 (2007-04-05) * paragraph [0021] - paragraph [0025]; claim 1; figures 1-5 *	7	
	-----		TECHNICAL FIELDS SEARCHED (IPC) E05F F16H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	27 September 2007	Balice, Marco

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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27-09-2007

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 19519948 A1	12-12-1996	NONE	
US 2006082188 A1	20-04-2006	NONE	
US 6195940 B1	06-03-2001	NONE	
DE 102005047309 A1	05-04-2007	NONE	

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